

# Resection for Pancreatitis in Patients with Pancreas Divisum

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Pancreas divisum is an anatomic duct variant, which may predispose to pancreatitis. Most patients are managed conservatively, but some patients justify attempts to improve drainage. The correct surgical approach is not yet established, and there has been no series published concerning pancreatic resection in this context. A 6-year experience with resection performed in 14 patients with severe pain is reported. There were no operative deaths, and 11 patients had good pain relief; steatorrhea developed in two patients and diabetes in one. The hypothesis that pancreas divisum may cause pancreatitis is supported by examination of resection specimens after pancreaticoduodenectomy; the dorsal part showed chronic pancreatitis and the ventral portion was normal.

THE PANCREAS DEVELOPS from two endodermal buds during the first 8 weeks of life (Fig. 1). The dorsal part constitutes the superior portion of the head and the whole body and tail and drains through the accessory papilla. The ventral part provides the inferior aspect of the head and drains with the common bile duct through the papilla of Vater. The ventral bud rotates posteriorly to fuse with the dorsal anlage; normally the ducts fuse so that most of the gland drains through the duct of Wirsung into the papilla of Vater. The connection between the accessory papilla and the main duct usually remains as Santorini's duct.<sup>1</sup>

In 1910, Opie recognized that the ventral and dorsal duct may not unite and called the entity "pancreas divisum"<sup>2</sup> (Fig. 2). In 1950, Millbourn found this variant in six per cent of all cases in detailed postmortem studies.<sup>3</sup> Hand confirmed these findings in a review of 30 papers and 3000 specimens, showing that the duct of Santorini constituted the main drainage system in five per cent of cases.<sup>4</sup>

Endoscopic pancreatography (ERCP) has focused attention on the anomaly during the past decade.<sup>5,6</sup> Many authors claim an association between pancreatitis and pancreas divisum,<sup>5-11</sup> but some dispute a causal relationship.<sup>12,13</sup> Kruse surveyed more than 40,000 ERCP examinations in Europe and reported to the European Congress of Gastroenterology and Endoscopy in Hamburg in 1980. The incidence of pancreas divisum in

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idiopathic pancreatitis was 10% (range 4%–40%), compared with a figure of four per cent for patients with biliary tract disease.

We have seen more than 300 patients with pancreas divisum during 5000 ERCP examinations and are convinced that the anomaly can predispose to pancreatitis due to relative obstruction at the accessory papilla. It follows that attempts to improve pancreatic duct drainage should be beneficial. Our early experience with endoscopic and surgical sphincterotomy of the accessory papilla was disappointing. This report concerns 14 consecutive patients who underwent pancreatic resection in our unit.

## Methods

### *Patients*

Fourteen patients underwent 15 pancreatic resections between December 1976 and January 1982. Four were male and 10 were female; mean age was 43 years (range 24–59). The mean duration of symptoms was 9 years (range 1–26 years); all patients suffered from repeated and typical attacks of acute pancreatitis (with hyperamylasemia), occurring at intervals ranging between 1 and a few months. Two patients were asymptomatic between attacks, but the remainder had persistent epigastric pain of varying severity and frequency. During the months before surgery, 12 patients were taking narcotic analgesics regularly, and eight had lost more than 7 pounds in weight. Three patients had steatorrhea, but none were diabetic. Patients with a history of alcohol abuse were excluded. No patient had a family history of pancreatitis.

Eight patients had previously undergone surgery for the same symptoms. Operations included cholecystectomy (five patients), sphincteroplasty at the papilla of Vater (two), and pseudocyst drainage (one).

### *Investigations*

Of the nine patients who had their gallbladders remaining, all had a normal oral cholecystogram and no

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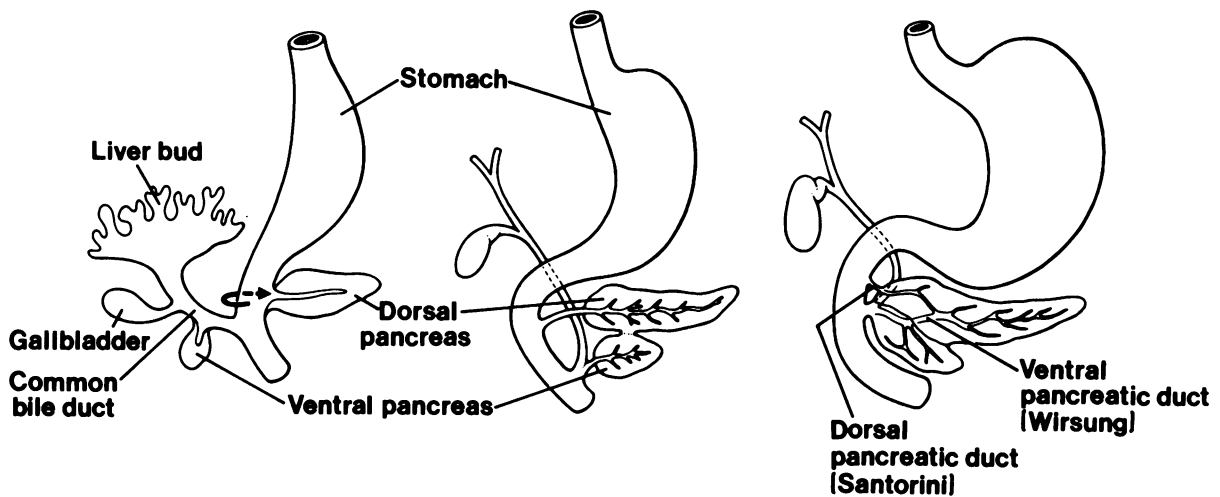


FIG. 1. The embryologic development of the pancreas. The ventral portion rotates portero-medially with the common bile duct fusing inferiorly with the dorsal portion and becoming the uncinate process.

stones were seen on ultrasound of the gallbladder. Fasting serum calcium and lipid estimations were normal in all patients, and none had pancreatic calcification on plain abdominal radiographs. Pancreatic function tests were not performed routinely. Ultrasound scanning of the pancreas was normal in eight patients. Four patients had scans consistent with chronic pancreatitis. The remaining two had cysts demonstrated (one in the body and the other in the tail) with otherwise normal parenchyma.

Endoscopic pancreatography showed a normal ventral pancreas in each patient (Fig. 3). The accessory papilla was seen in all patients, but was cannulated in only eight; four of the dorsal pancreatograms were normal, but four had changes of chronic pancreatitis. One patient, whose accessory papilla could not be cannulated, had an abnormal dorsal duct demonstrated by percutaneous pancreatography (Fig. 4).

## Results

### Surgery

The pancreas appeared normal at laparotomy in five patients and fibrotic in the remainder; one of the cysts demonstrated at ultrasound scanning (in the tail of the gland) was confirmed. No other pathology was evident in any patient. Ten patients underwent a standard Whipple procedure. Four patients underwent 70% distal resection with drainage into a Roux-en-Y jejunal loop; one of these patients developed recurrence of pain after 6 months and was treated by 95% resection.

The only operative complication was an iatrogenic splenectomy. Following distal resection, one patient developed a pancreatic fistula, which closed sponta-

neously. There was no operative mortality, and all patients were alive at the time of follow-up examination.

Operative pancreatography was consistent with the results of preoperative imaging techniques when the dorsal system had been cannulated. In the remaining five patients, the operative pancreatogram was normal in four patients and showed changes consistent with chronic pancreatitis in one.

### Pathology

All of the surgical specimens showed changes typical of chronic pancreatitis of varying severity. Two pancreaticoduodenectomy specimens were fixed and mounted with great care to allow comparison of ventral and dorsal portions; in both cases, the dorsal gland showed chronic pancreatitis and the ventral portion was normal (Fig. 5).

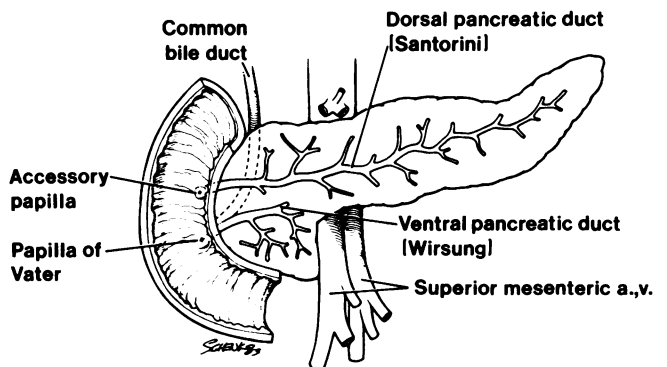


FIG. 2. Pancreas divisum with nonunion of the dorsal and ventral pancreatic ducts. The ventral duct drains with the common bile duct at the papilla of Vater. The dorsal duct drains at the accessory papilla approximately 2 cm anterosuperior to the papilla of Vater.

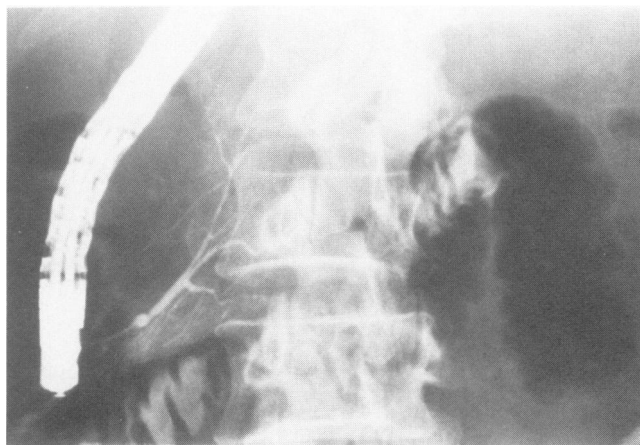


FIG. 3. Endoscopic pancreatogram via the papilla of Vater in a patient with pancreas divisum.

### Follow-up

All patients were interviewed and examined by an independent visitor to the department (A. John Blair). A review was made of all hospital records, radiography and history. Patient follow-up ranged from 2 to 7 years except for one patient who was followed for 6 months.

All patients were alive at the time of review. Pain status is shown in Table 1. Two of the four patients who had distal resections were completely free of pain at 4 and 7 years. The remaining two developed severe pain at 6 months and 2 years. The patient who developed pain at 6 months underwent a second operation. At reexploration, she had a stricture at the pancreaticojejunal anastomosis and underwent a 95% resection. She developed steatorrhea and insulin-dependent diabetes but was pain-free 4 years later. The patient who developed pain

after 2 years refused further surgery and required narcotics for pain relief.

Eight of the 10 patients who had Whipple procedures had good results; four were completely free of pain at 6 months, 1 year, 2 years, 3 years, and 4 years, respectively. The other four had occasional pain not requiring strong analgesia at 2 years, 5 years, and 6 years. The final two patients developed recurrence of severe pain requiring analgesics at 12 and 18 months. Both patients had pain similar to that experienced prior to surgery.

Relief of pain after surgery did not appear to correlate with age, sex, length of history, or patterns of previous pain. However, the size of the dorsal duct at the time of operation was an important predictive factor. All five patients with ducts greater than 8 mm in diameter had good results, but only five of the nine patients with ducts less than this size were satisfied after the drainage procedure. The four patients with bad results included two 70% distal resections and two Whipple procedures.

### Pancreatic Function and Nutritional Status

The three patients with steatorrhea before operation continued with this after surgery; two patients developed steatorrhea after Whipple procedures. The patient who underwent a 95% resection developed steatorrhea and diabetes.

Five patients had no significant change in weight, and two patients lost more than 5 pounds. Three patients gained more than 5 pounds, and four patients gained greater than 10 pounds.

### Discussion

In 1976, Cotton and Kizu suggested that the anatomic variant of pancreas divisum could cause pancreatitis, due to relative obstruction at the accessory papilla.<sup>14</sup> The hypothesis was based on the observation that the incidence of the variant was higher in patients with idiopathic pancreatitis than in controls. This view has been supported,<sup>5-11</sup> denied,<sup>12,13</sup> and discussed.<sup>15</sup> There are problems in interpreting the available epidemiologic data. Autopsy series are relatively small and confused by different anatomic definitions and selection of material; ERCP series are skewed by patient selection. The true incidence of the variant cannot be defined unless accessory papilla cannulation is attempted and succeeds in every patient in whom contrast injection at the main papilla fails to outline a pancreatic duct; many patients have no recognizable ventral portion. The situation is further confused by difficulties in defining pancreatitis, at least at an early stage, and the influence of alcohol abuse.

The patients in this series provide better evidence for the importance of the variant as an etiologic factor in

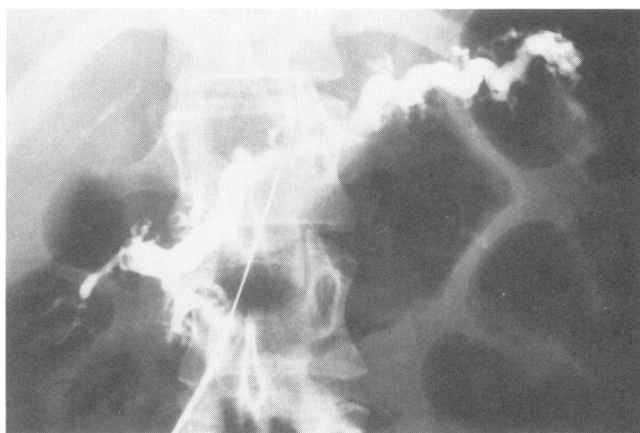


FIG. 4. Percutaneous pancreatogram performed ultrasonographically (same patient as Fig. 3) showing typical changes of chronic pancreatitis with a dilated duct. The accessory papilla could not be cannulated endoscopically.

pancreatitis. None of the patients had an alcohol problem, and all had histologically proven pancreatitis. In all of the 14 patients there was evidence of disease in the dorsal pancreas, while the ventral part appeared normal. Six patients had abnormal dorsal ducts (four at endoscopy, one at operative pancreatography, and one at percutaneous pancreatography) with normal ventral ducts. Two of the pancreaticoduodenectomy specimens were carefully fixed and mounted so the two elements of the pancreas could be separated. Cross-sections through the specimens showed marked histologic discrepancy, the ventral portion remaining normal with gross pancreatitis in the dorsal segment. The histology of the dorsal segments was typical of obstructive pancreatitis without the features of chronic pancreatitis from alcohol abuse.<sup>16</sup>

Actual obstruction at the accessory papilla is more difficult to document in life. However, in fresh pancreaticoduodenectomy specimens, the accessory papilla would admit only a 0.5-mm diameter probe. Keith and colleagues reported similar findings at surgery; the dorsal orifice measured 0.5 mm, whereas the ventral orifice ranged from 1 to 3 mm.<sup>17</sup>

Those authors who accept the association between pancreas divisum and pancreatitis usually refer to recurrent attacks of acute pancreatitis, rather than chronic pancreatitis.<sup>6,7,11</sup> This is a problem of definition. Although many of our patients had severe recurrent attacks of pain with hyperamylasemia and substantial symptom-free periods, all had histologic proof of chronic pancreatitis. Detailed pancreatic imaging by ultrasound and computerized tomographic (CT) scans were not sufficiently developed at the time these patients were evaluated, and function tests were not performed routinely. The only documentation of chronic damage prior to surgery was provided by four abnormal endoscopic dorsal pancreatograms and one abnormal percutaneous pancreatogram. Four patients had normal duct radiographs and normal appearance of the pancreas at laparotomy; the diagnosis would not have been made without histologic examination. This review and other recent reports<sup>18-20</sup> suggest that pancreas divisum can progress to chronic pancreatitis presumably from acute recurrent attacks. This represents a different process from the chronic pancreatitis of alcohol abuse.

Whether or not the anatomic variant was responsible for pancreatitis in our patients, the symptoms were certainly severe enough to warrant surgical intervention. All had pain requiring frequent admission to hospital and narcotic analgesia. Conservative management with a diet low in fat, complete abstinence from alcohol, and speculative use of pancreatic enzyme supplements failed to help. Our first attempts at endoscopic sphincterotomy at the accessory papilla were not encouraging.<sup>21</sup> There-

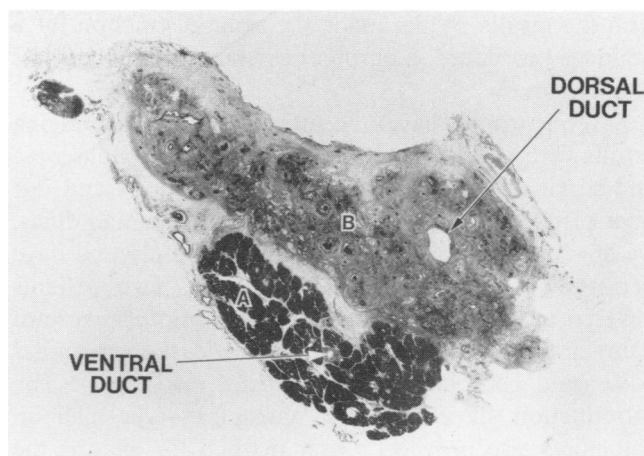


FIG. 5. Cross-section of the head of the pancreas. The entire gross specimen was imbedded, sectioned, and strained. The figure represents a photograph of the slide without magnification. The ventral pancreas (A) has normal paranchyma with a normal sized duct. The dorsal gland (B) demonstrates chronic pancreatitis with atrophy, fibrosis, and a grossly dilated duct.

fore, we decided to try surgical therapy in these patients with incapacitating pain. Detailed review of the literature provided little guidance as to the appropriate operation. Interpretation of the surgical literature was difficult because of the overriding influence of alcohol abuse and the controversy over the relevance of duct dilatation.<sup>22-24</sup> Since the patients in this group had ducts less than 1 cm in all cases, we chose resection over drainage procedures.

The overall results of pancreatic resection in this series (ten proximal, four distal, and one 95% resection) are good after a follow-up of 2 to 7 years. Only three patients required narcotic analgesics. Although one patient obtained complete pain relief after undergoing a second operation (95% resection), she was rendered diabetic with steatorrhea. It is important to emphasize that all patients with a dilated dorsal duct system greater than 8 mm had a good result, whether the resection was distal or proximal. Only one-half of those patients with small ducts who had resection and drainage were satisfied

TABLE 1. Results of Surgery with Pain Relief

Procedure	No. of Patients	Pain Following Surgery		
		Severe	Mild	None
Pancreatico-duodenectomy	10	2	4	4
70% to 80% distal resection	4	2*	—	2
95% resection	1	—	—	1
Total	15	4	4	7

\* One patient went on to a 95% resection.

with the results. White made the same distinction for a drainage procedure in chronic pancreatitis for ducts less than 8 mm.<sup>25</sup>

Several groups have recently reported encouraging results with accessory sphincterotomy, both endoscopic and surgical.<sup>11,17-20,26</sup> Because of these reports and our poor results with resection in patients with small ducts, we are reevaluating accessory sphincterotomy and have performed seven during the past year. Two patients have required further operative intervention because of pain; one is completely pain free; and the remainder have mild complaints not requiring medication. The introduction of endoscopic angioplasty-type balloon catheters also provides a new method for dilating the accessory orifice after initial endoscopic or surgical incision. Further studies are required with careful long-term documentation.

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